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A Pattern of Surface Coastal Circulation Inferred from Surface Salinity-Temperature Data and Drift Bottle Recoveries .

Ву Arthur R./Miller

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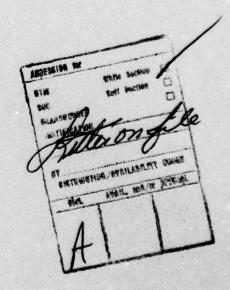
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Table of Contents

	Page
ABSTRACT	1
INTRODUCTION	2
DATA	3
SALINITY AND TEMPERATURE	4
DRIFT BOTTLES	6
RELATION OF DRIFT BOTTLE RECOVERIES TO SALINITY- TEMPERATURE DISTRIBUTION	
TRAJECTORIES OF THE DRIFT BOTTLES	9
THE PATTERN OF SURFACE CIRCULATION, MAY 1951	10
CONCLUSION	13
REFERENCES	14
APPENDIX	15



ABSTRACT

A detailed description of the surface coastal circulation for May, 1951, based on drift bottle recoveries and salinity-temperature data is presented. The nontidal drift is traced from Block Island to Cape Hatteras and described as a fluctuating current meandering, forming eddies, and splitting during its southward migration.

INTRODUCTION

To aid in the interrelation of local coastal investigations along the northeastern coast of the United States, a rapid hydrographic survey was made of the coastal water between Block Island and Cape Hatteras within the 25 or 30 fathom curve. The surface circulation is described for the month of May, 1951, from data obtained during the survey and from drift bottle recoveries in the area.

The coastal region between Block Island and Cape Hatteras is characterized by a broad continental shelf sloping gently from the coast to the 100 fathom contour. Its seaward boundary roughly parallels the coastline except near Cape Hatteras where the shelf is considerably narrowed. The edge of the shelf is interrupted by several aubmarine canyons, most notable of which is the Hudson Canyon. The latter is concerned in this report only where its landward extension, the Hudson Gorge, deeply indents the 30 fathoms The coastline of the area is that of a submerged contour. coastal plain and consists of numerous accessible beaches, spits, and barrier islands with only a few headlands and backshore cliffs. Major river systems breach the coastline at Chesapeake and Delaware Bays and at the New York Harbor Entrance. Runoff from western and southern New England enters the coastal area by way of Long Island and Block Island Sounds.

Surface circulation may be determined directly from measurements of the surface movment of the water. Because of tidal influences, such measurements over a wide area are of little practical use for presenting a detailed pattern of surface circulation. Tidal oscillations complicate the current measurements when the mean motion is sought. The nontidal drift is interpreted as the net result of tidal motion, and, from the rotary nature of tidal currents, the nontidal drift may be only a small portion of the measured current. Since the net result of the total motion of the water is to shift water masses from one place to another, circulation is usually determined indirectly from the distribution of salinity and temperature.

The distribution of salinity and temperature for the region has been discussed at length by bigelow (1933) and Bigelow and Sears (1935). Prior to spring freshets, the salinity along the coast is at a maximum while the temperature is at its minimum. As one of the basic year-round features of the coastal distribution of salinity, isohalines run more or less parallel to the coastline, with converging of the isohalines and increase in the range of salinity values south of Chesapeake Bay. The mean surface

salinity along the 200 meter (approximately 100 fathoms) contour is 34.1 % (salinity values decreasing shorewards) with February representing the month nearest the mean. The basic parallelism of the isohalines is broken up by considerable variations in salinity about the mouths of rivers and inlets, depending on the discharge of fresh water, and also by compensatory indrafts of high salinity water. There is a general southwesterly drift along the coast which is borne out by the fact that no major changes in salinity occur lengthwise of the shelf.

The temperature distribution is more subject to change in the coastal water than salinity, particularly during the spring season. As the surface water is warmed, producing a shallow thermocline, the vertical strata become increasingly stable, inhibiting the turbulent transfer of heat downwards. Stability of the vertical column is further increased due to spring freshening. Thus, between April and May, the surface water may absorb heat to the extent of increasing the surface temperature as much as 4 to 6°C.

According to Bigelow, the first three weeks in May make up the transitory period in which winter-type water (vertically homogeneous water with tendencies towards increased temperatures near the bottom) changes to summer-type water (vertically stable water, much colder on the bottom). In addition to the local changes in the coastal water, there are effects of transport in and out of the area. Drifts from the east or northeast may act as chilling or warming agents, the former if the drift is longshore, the latter if the drift is from offshore. For example, Bigelow mentions recurrent cold surface intrusions spreading west and south from Cape Cod but seldom, if ever, passing the offing of New York.

DATA

In a region with a variety of hydrographic conditions such as those described, considerable detailed observations are required. This requirement is stressed during the transitory month of May, for, not only are detailed data needed, but, in view of the rapidly changing state, data should be acquired synoptically. With this objective, the cruise of the R. V. ALBATROSS III was planned to obtain as much detailed hydrographic information over a large area as could be gathered in a short period of time.

Most of the hydrographic data were collected while the ship was underway. Subsurface data (to be dealt with

in a later report) were obtained with the Sea Sampler and Bathythermograph, instruments designed to be used while underway, interposed with a few standard hydrographic stations. The surface data were acquired with the Salinity-Temperature-Depth Recorder, a continuously recording instrument which measures the temperature and conductivity of sea water. Drift bottles were released at periodic intervals throughout the cruise.

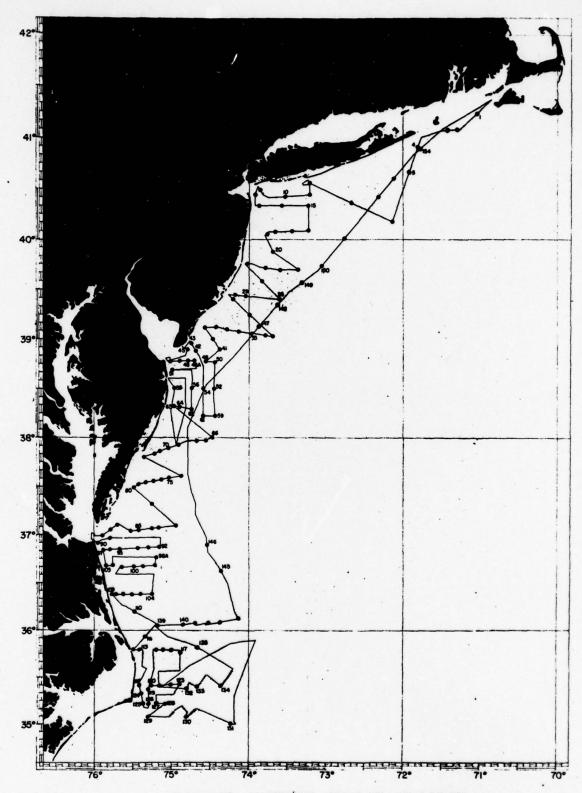
The cruise plan is shown in Figure 1. The R. V. ALBATROSS III followed a zig-zag course, more or less, from near shore to the 25 fathom curve. At the end of seven days at sea, the inshore work was completed and investigations were carried out into deep water as far as the Gulf Stream. Connected points during the cruise served as checks on the synoptic character of the survey. In some localities changes over a lapse of time were observed but these were not sufficient to alter the general treatment of the survey as a composite unit.

At any point along the track, measurements of salinity and temperature at the surface were available from the STD record. Whole values of salinity and temperature were plotted over charts of the ship's track and were interpolated wherever necessary to maintain continuous plots. The plotted values were uncorrected for consistent errors and were somewhat less than the actual values. The surface plots of salinity are shown in Figures 2, 3, and 4; surface plots of temperature are shown in Figures 5, 6, and 7.

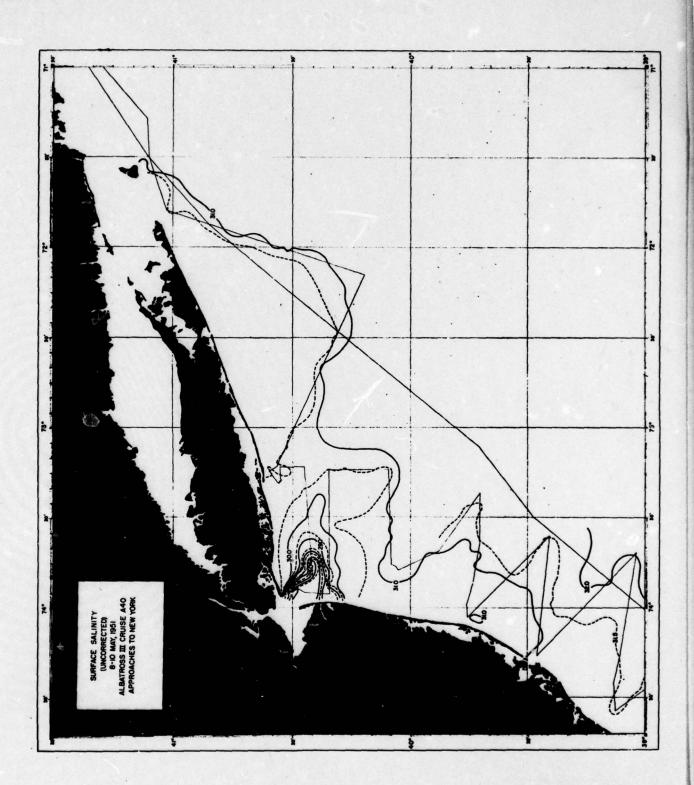
SALINITY AND TEMPERATURE

Perhaps the most striking feature of the salinity diagrams is the meandering of the isohalines. Bigelow attributes the variance from parallelism of isohalines to indrafts of salt water from offshore balancing the seaward migrations of fresh water. Supposing this to be the case for May, 1951, the coastal water is broken up into numerous offshoreonshore drifts which, superimposed over the coastwise drift, lead to a complicated pattern of surface circulation.

The 31 % oo isohaline can be traced at intervals from Block Island to Cape Hatteras. It serves as a convenient boundary between coastal water and water freshened by the local river systems. In this report coastal water will be defined as water having salinity values between 31 % o and 34 % o. The coastal area between Block Island and the New Jersey coast is bounded by the 31 % o isohaline. The gradient of salinity adjacent to this isohaline is weakest



TRACK CHART - ALBATROSS II - CRUISE A40 - MAY 8-20, 1951.
DRIFT BOTTLE RELEASE STATIONS



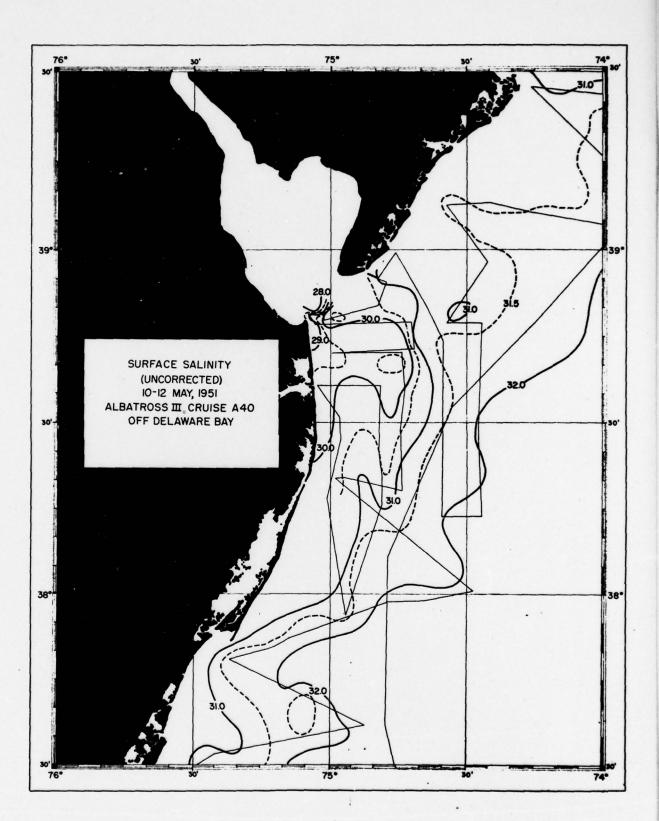


FIG.3

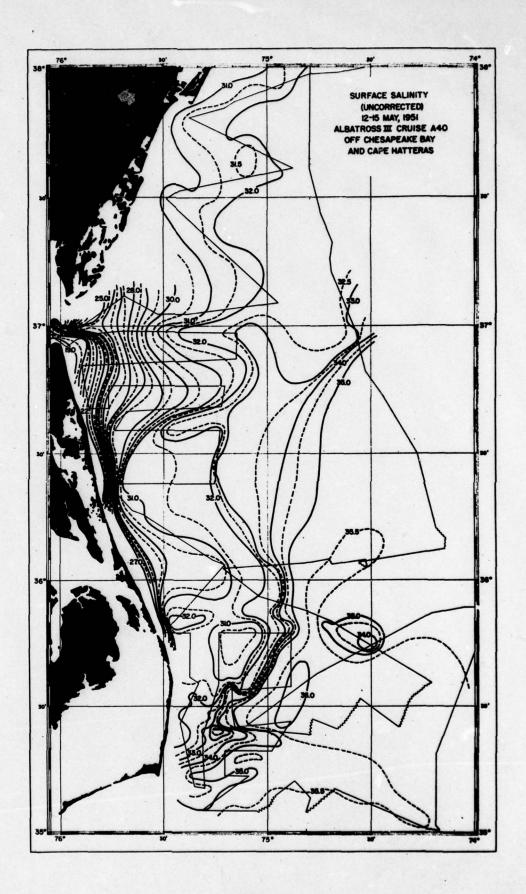
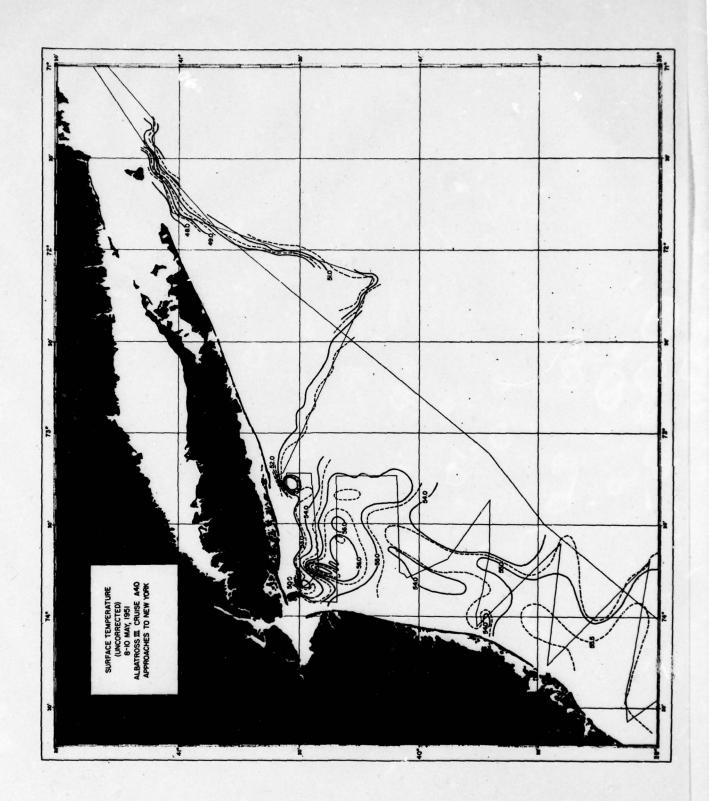


FIG.4



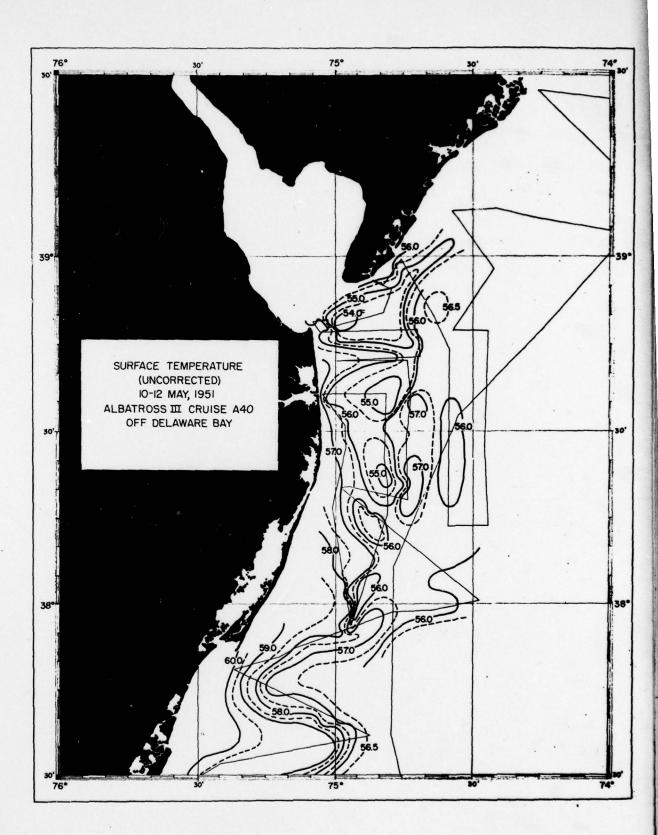


FIG.6

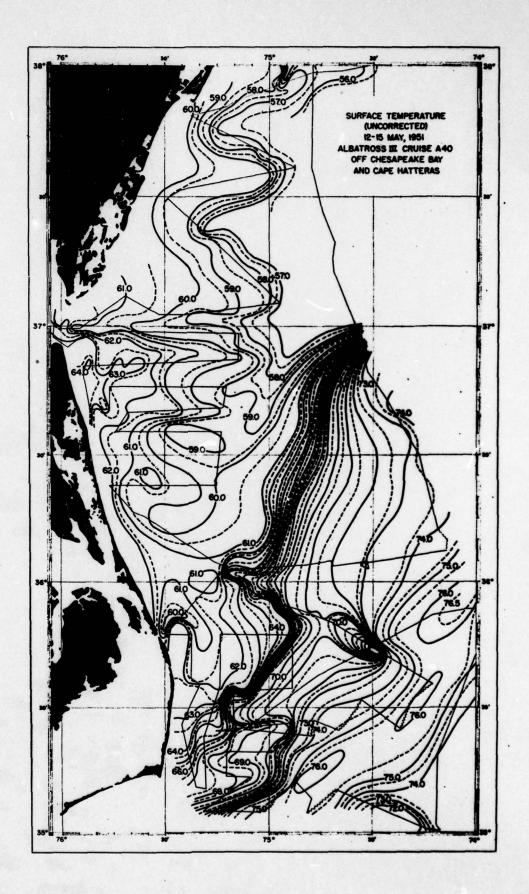


FIG.7

in an area east of the New York Harbor Entrance and in another area south of the harbor. Well mixed riverfreshened water is apparently flowing out of block Island Sound and spreading seawards in a southwesterly direction. The spread of this low salinity water is limited and its effect vanishes or becomes indistinguishable southeast of Fire Island Inlet. Here a tongue of saline water, nearly coastal in character, extends shorewards and enters the western reaches of the Long Island shore where it meets the effluent leaving New York Harbor. The Hudson River effluent extends seawards for 20 to 30 miles to be confined again by another indraft of coastal water from the soutest. South of 40°, freshened water appears in limited amounts along the New Jersey shore until it disappears completely at 39°30'.

North of Delaware Bay coastal water hugs the coast and even encroaches upon the mouth of the bay itself. The Delaware effluent is apparently well mixed and comparatively small in volume. It extends seaward for a short distance and also extends south along the shore. An indraft of coastal water from the south tends to separate the seaward and shoreward drifts. The 31 % of isohaline encloses a relatively narrow band (20 miles wide) of freshened water that extends from Cape May to Chincoteague Inlet.

At Chesapeake Bay the water undergoes a distinct change. The salinity of the effluent is as low as 19 % oo and salinities \$\leq 31 \quad \text{\congruence}\$ oo are observed well to seaward. The effluent is apparently split during its eastward migration by an indraft of coastal water. The river-freshened water is traceable northeast of the bay entrance, but is most prominent to the south and southeast. Considerably freshened water of \$\leq 27 \quad \text{\considerably freshened water of } \leq 27 \quad \text{\considerably os salinity extends south as far as Oregon Inlet.} An increase in velocity in this area is probable, due to the constriction of fresh water flow resulting from the effects of coastal water indrafts. At Cape Hatteras, the coastal water becomes part of the oceanic circulation. Its offshore movement is marked by sporadic tongue-like extrusions into regions of high salinity.

The continuity of the temperature distribution for May, 1951, is not as clear as the salinity distribution. In many instances, isotherms have to be drawn as isolated pools. In comparison with Bigelow's data, one might assume that vernal warming was somewhat earlier than usual in 1,51. Generally, surface temperatures were 2 to 4°F. warmer than the warmest chart of temperature presented by Bigelow for the month of May.

In the New York area maximum temperatures were recorded near the entrance to the harbor. This maximum coincided with the indraft of saline coastal water already mentioned; however, the warmer temperatures are not continuously traceable to the offshore regions. The coldest water in this area was found along the Long Island coast. The fact that this water is also saline suggests that its origin is probably from the block Island area. The temperature distribution for the New York area, although warmer than Ketchum's April survey, corresponds closer to the observed winter distributions. January and February surveys show wedges of warm water entering the area from the southeast (Ketchum, Redfield, and Ayers, 1951).

Off the entrance to Delaware Bay a pool of water colder than 54°F. was observed. Further south, cool water from the bay is interposed between 57°F. water. South of Chincoteague Inlet there is a reversal in the horizontal temperature gradient. Water is warmest near the coast, in contrast to the New York area, where it is coldest near the shore.

The warm water along the coastline continues as far south as Currituck, below Chesapeake Bay, where another gradient reversal takes place and the warmer surface water lies offshore. In this area maximum inshore temperatures lie just south of Chesapeake Bay Entrance. The indraft of high salinity coastal water which contributes to the southerly flow along the coast north of Oregon Inlet brings with it chilled water from the north. In the Cape Hatteras region the cold coastal water intrudes upon the warm oceanic circulation.

In its most general aspects the distribution of salinity and temperature for May, 1951, is not much different from previous May data. However, the detailed distribution shows considerable meandering of the isohalines and isotherms and allows a finer interpretation and delineation of the water masses. The continuous nature of the data permits an effective analysis of the probable origins of the water masses and their general movement during the time of survey. From the combination of the salinity-temperature analysis and the direct measurements from drift bottle data which are assumed to represent the results of nontidal surface transport, a reasonable pattern of surface circulation was developed for the month of May.

DRIFT BOTTLES

Drift bottle data, when applied to studies of the motion of the surface layer, are sometimes confusing because of

apparently contradictory trajectories. In the Gulf of Maine, Bigelow (1927) resolved conflicting data into rational order by assuming curved drift bottle trajectories which traced out the counterclockwise circulatory system of that area. Within the seeded area (Gulf of Maine) the drift bottle data were sufficient to justify the manipulation of the trajectories. It was more difficult to justify the adjustment of drift bottles that left the area.

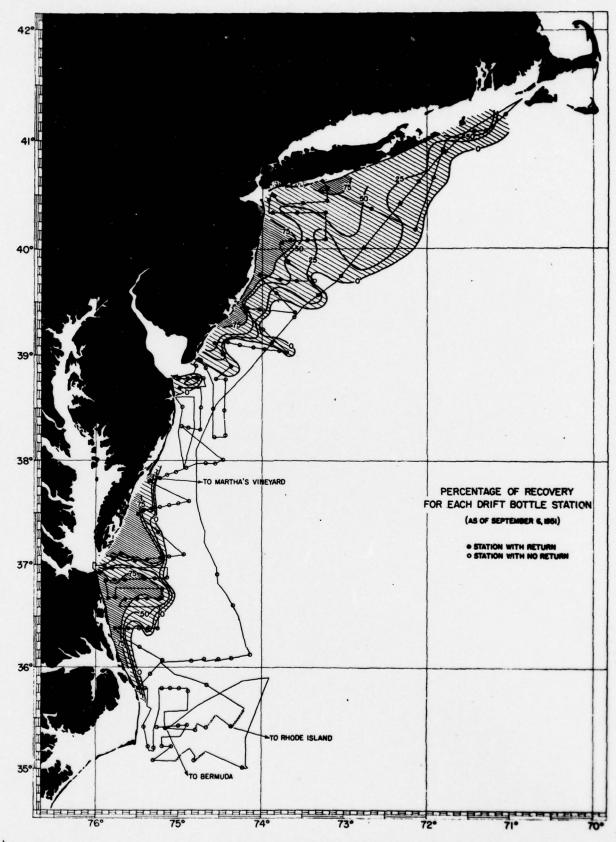
Bottles set adrift in the vicinity of Cape Cod (Bigelow, 1927) stranded along the shores of southern New England, New York, Virginia, and North Carolina, more or less in that order according to the distance they were set offshore. From recent investigations (Redfield and Walford, 1951) a similar order of recovery is to be expected off the entrance to New York Harbor. Bottles set adrift 10 miles from the beach may strand between Cape May and Cape Hatteras, while those within the 10-mile limit may be beached locally. More recent data (Powers and Ayers, 1951) show marked differentiation between local and distant returns.

A closed circulation such as occurs in the Gulf of Maine is suited to the task of adjustment of trajectories. The coast to the west and south of Cape Cod is less suited, for, within a short distance of the coast, bottles will usually drift out of the local area. Once a bottle has left the seeded area, the difficulties in adjusting the drift of the bottles to rational order increase while justification for the manipulation becomes vague. It is fortunate that, in the present study, the entire coastal region from Block Island to Cape Hatteras was well-distributed with drift bottle stations. Thus, the recoveries supplemented one another in tracing the longshore surface circulation.

The chart in Figure 1 shows the positions of the drift bottle stations. In all, 1,740 bottles were released in lots of 12 at 145 stations. These were plain 12-ounce bottles that were ballasted to float upright in sea water with only a small portion of the neck appearing above the surface. As of August 30, 1951, 478 bottles had been returned from 73 stations, that is, 27.6 % recoveries from 50% of the stations. This excellent return was compared with the distribution of salinity and temperature.

RELATION OF DRIFT BOTTLE RECOVERIES TO SALINITY-TEMPERATURE DISTRIBUTION

The percentage of onshore drift bottle recoveries from each drift bottle station is shown in Figure 8. As would be



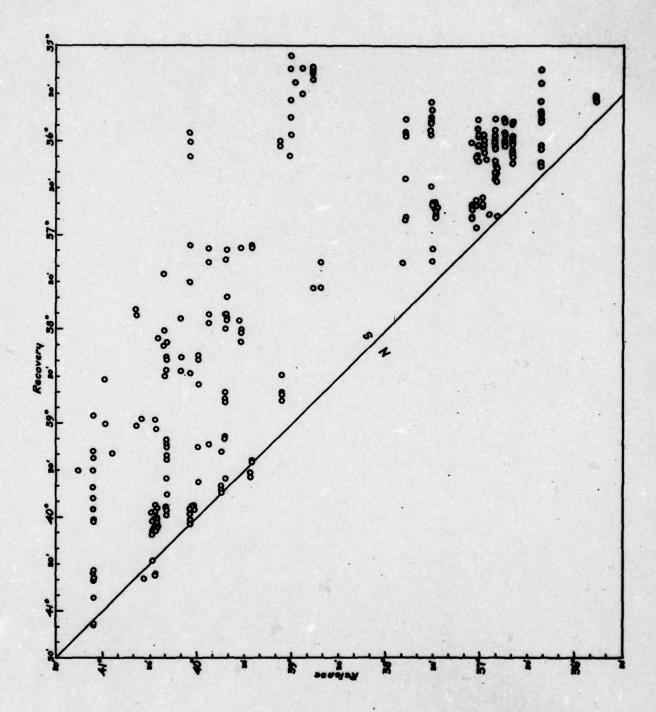
TRACK CHART - ALBATROSS II - CRUISE A40 - MAY 8-20, 1951.

expected, stations with greater than 75% return are nearest to shore, and diminishing returns are indicated progressively offshore. Lower percentages are shown leading inshore to the mouths of the estuaries. For instance, minimum return is indicated well in toward the entrance of New York Harbor. This agrees with similar indications in the area from other experiments (Redfield and Walford, 1951). Lack of returns is conspicuous off Delaware Bay; those bottles which were recovered from this area beached in the vicinity of Cape Hatteras. In contrast, practically all of the stations off New York produced recoveries. The general correspondence of the lines of recovery with the isohalines (30 % to 32 % co) suggests a relationship of onshore surface drift with the distribution of salinity.

Figure 9 shows the latitude of release plotted against latitude of recovery. The figure illustrates that very few bottles drifted to the north and, in any case, only drifted a few miles in that direction. It is apparent that the large number of recoveries from the New York area is accounted for through long distance drifts. The local recoveries were from nearshore stations. The longest drifts of the recovered bottles were from sets between 38°30' and 40°N. Generally, the bottles released in coastal water (>31°/oo) drifted the greatest distance, while the short drifts were made by bottles released in river-freshened water. Both long and short drifts come ashore above Cape Hatteras with only a few bottles rounding the Cape.

Rough computations of density (σ t) were made for place of recovery of each drift bottle in order to compare these values with the density of release. The differences in these density values were classed and averaged for intervals of 10 miles of distance traveled. These differences are shown in Figure 10 for recoveries during the first and second week of being cast overboard. Within the first week, bottles stranded in regions of greater density than release; within the second week, bottles also stranded in regions of greater density but with less differences. The differences of density also decrease generally according to the distance traveled. It is worthy of note that the average difference in density (σ t) between release and recovery was 2.4 during the first week and 0.2 during the second week.

The above data indicate a tendency for the drift bottles to float along lines of equal density and indirectly along lines of similar salinities and temperatures. If the slope of the sea surface were known and were associated with the distribution of surface density, the above relation would suggest surface flow in the geostrophic sense. In addition,



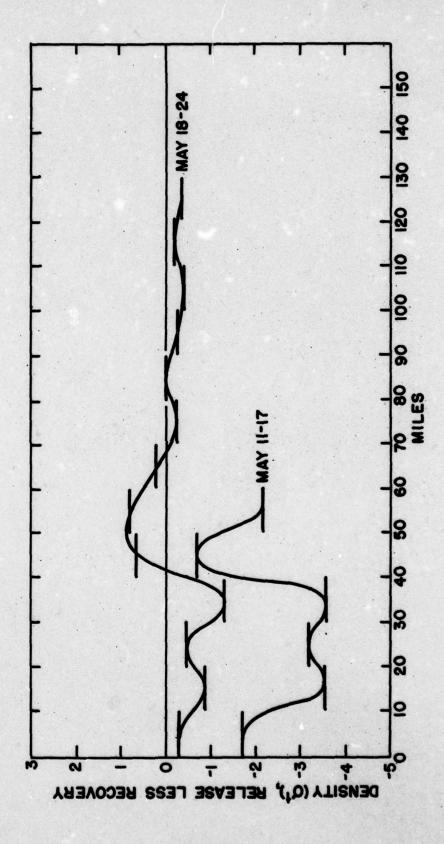


FIG.10

there is probably a component of drift in the direction of greater density or downslope. Apparently, this downslope component is small compared to the total drift, but it is not known whether this is a general or local effect.

TRAJECTORIES OF THE DRIFT BOTTLES

If we are to obtain more detailed information of the surface drift through the use of drift bottles, we must make certain assumptions in order to adjust the minimum values. The degree of certainty in which the actual drift is represented will depend on the validity of these assumptions. The basic assumptions involved in this study are concerned with velocity and distance. In general, velocities are assumed to be approximately the same within a given area. A trajectory is assumed to follow the shortest path between place of release and recovery without conflicting with other trajectories. It is assumed that the paths or trajectories of the drift bottles are restricted to a minimum of crossings and that, in no case, do paths cross normal to each other.

In addition to these assumptions, two other factors were taken into consideration. First, it is not known how long a bottle had been stranded on the beach. The time factor is uncertain within limits, but due to the excellent percentage of recoveries and the particular area which was surveyed, the time of stranding was assumed to be within a day or two of the time of recovery. Second, the question of wind effect upon the individual bottles has been considered only as of relatively minor importance. Previous experiments have shown no appreciable affect due to wind (Webster and Buller, 1950).

The problem of adjusting trajectories to fit the basic assumptions is essentially one of trial and error until all criteria are fulfilled within reason and little or no inconsistencies remain. Paths were drawn, measured, and redrawn using facts and inference, starting from the best known to least known material, until the ultimate objective was achieved.

The paths of bottles representing quick returns over short distances were drawn first, then the paths of neighboring bottles from nearby stations were tentatively adjusted to fit the basic assumptions, either in rate of travel, or distance traveled. Usually, when distance traveled was changed by distorting the paths, the resultant rate of travel for that particular bottle fell in line with those of the initial reference bottles. If recovered bottles from a line

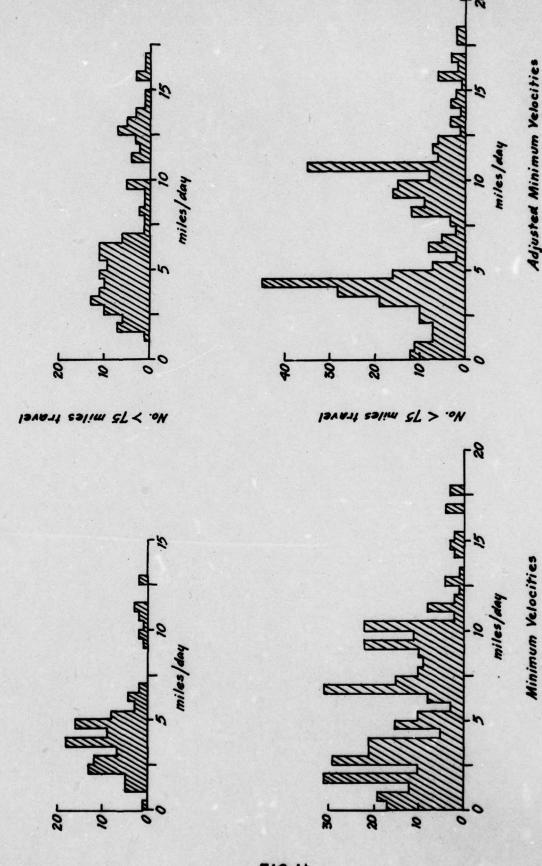
of stations apparently passed through another line from which there were no returns, it was obvious that their trajectories had to be detoured around the second line. In this way, the paths were reconstructed.

It has been assumed that velocities within a given area should be reasonably consistent. In other words, the presence of a definable current may be characterized by velocities within a definite range. A frequency diagram, Figure 11, illustrates the minimum drift velocities before and after adjustment. These velocities are classed according to distance traveled. The number of initial minimum velocities are distributed at random over a wide range. Upon adjustment of the trajectories, definite maxima appear in the diagram. This same tendency occurs if the diagram is again redrawn and classed according to the area in which the bottles were set adrift (Figure 12). Characteristic model velocities appear for the New York and Chesapeake area which were less clear for the unadjusted minimum values.

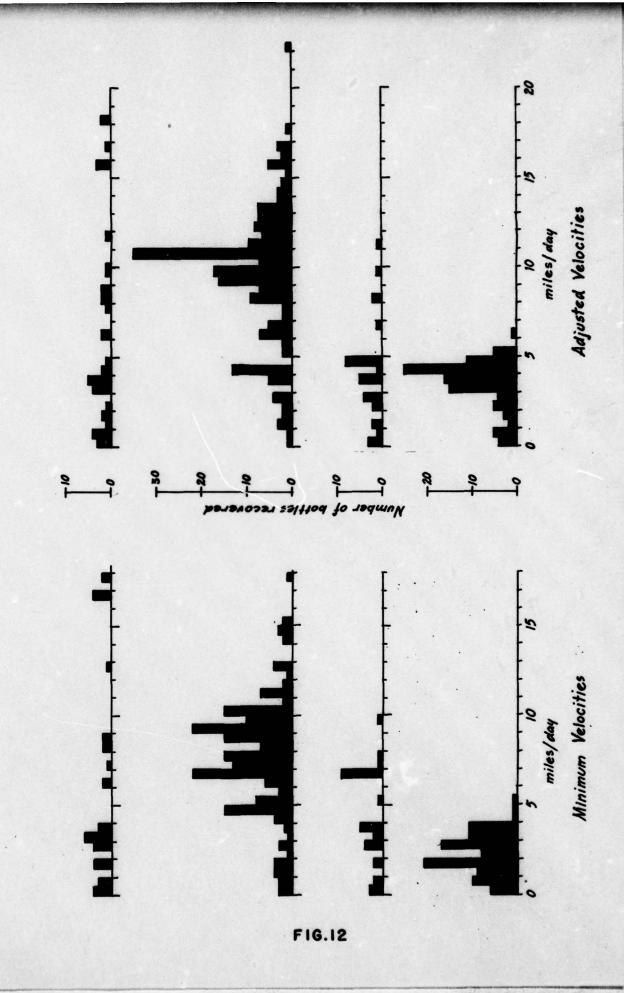
Apparently reconstruction of the trajectories was sufficient to satisfy the basic assumptions. While there is no assurance of the reality of the deduced paths, one can assume a general correspondence to the actual drift. The provisional interpretation of flow in the geostrophic sense served as a guide for checking the interpolated paths of the drift bottles. Figures 13, 14, and 15 show the deduced trajectories. The arrows in the figures represent the direction of drift inferred from salinity and temperature. In this way a consistent pattern of surface circulation was obtained within and beyond the onshore drift pattern.

THE PATTERN OF SURFACE CIRCULATION, MAY, 1951

Generally, the coastal drift is unmistakably southward as far as Cape Hatteras but here the southward trend immediately ceases and the drift turns east or northeast. The southerly drift is not direct or confined in the sense of a broad slow current. It meanders, divides, eddies and otherwise shifts as evidenced by the distribution of temperature and salinity. Since the nontidal motion appears to be a function of density, the effective drift due to fresh water contributors may be a large factor in their particular localities. Estimates of surface velocity in local areas are limited to establishing an approximate minimum speed. From these estimates, one can expect the velocity of the surface drift to be as much as 20 miles per day south of Chesapeake Bay and as little as 3 miles per day in the New York area.



Frequency Diagram for Recovered Bottles.



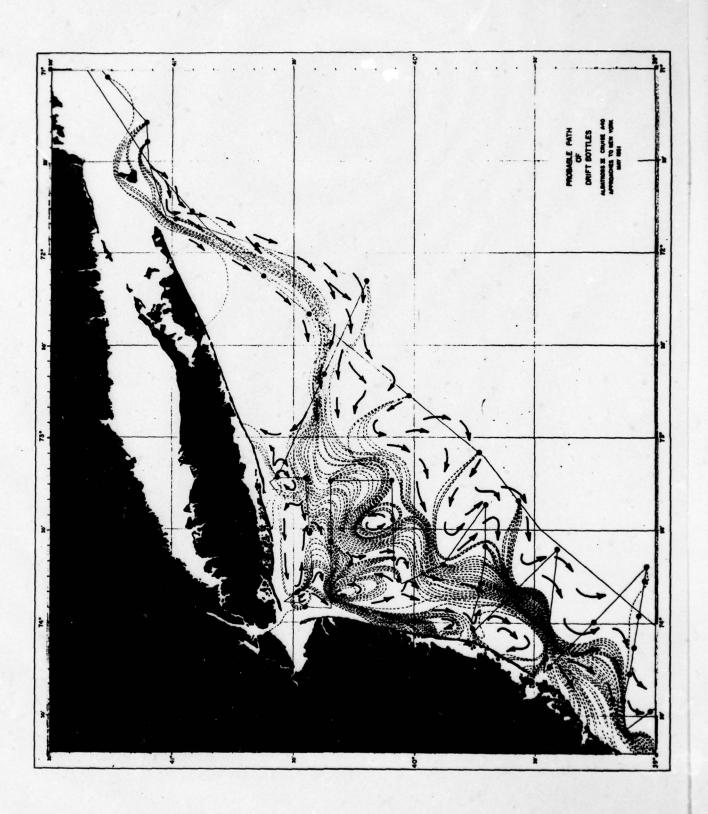


FIG.13

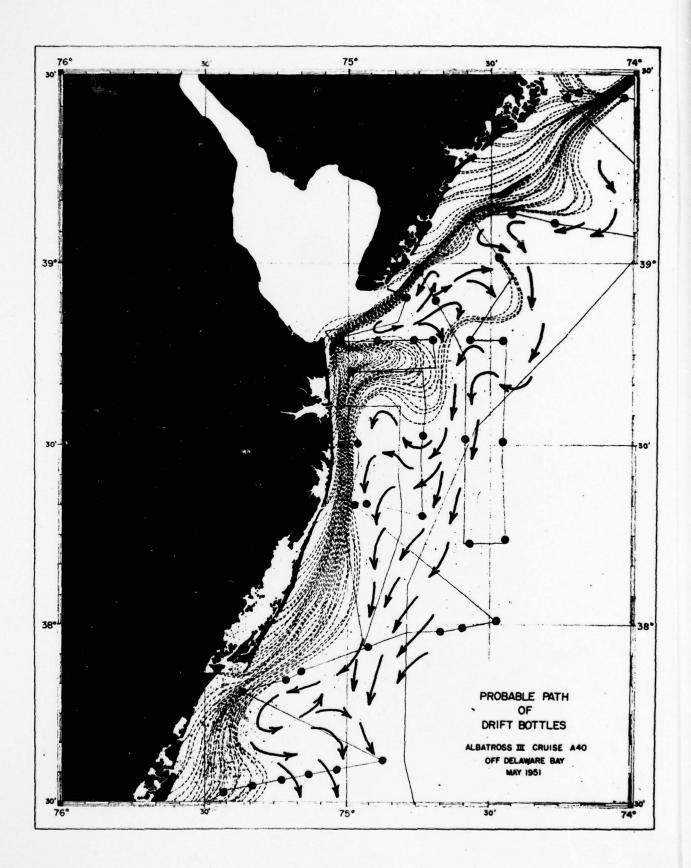


FIG.14

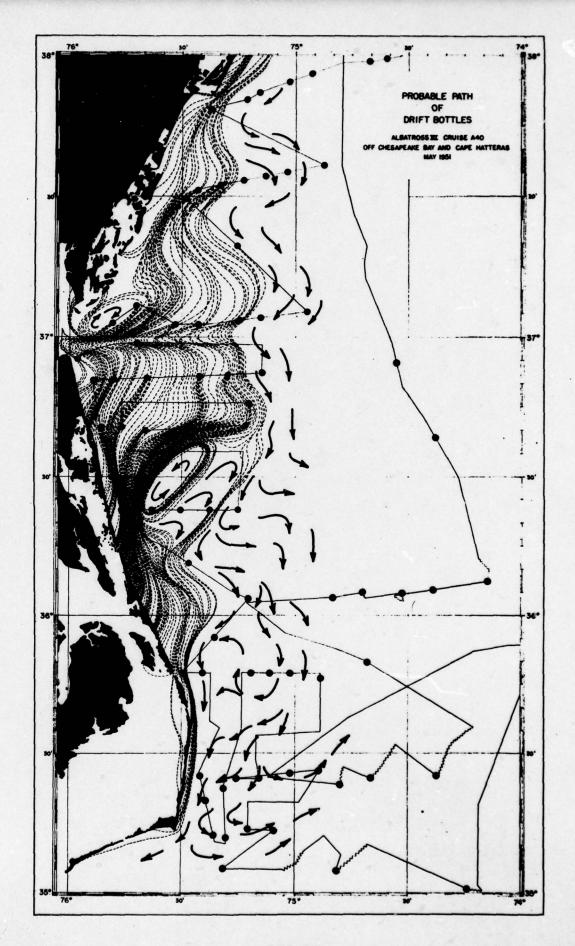


FIG. 15

Off New York, the pattern of surface circulation showed a somewhat confined current heading seawards from the eastern end of Long Island in a southeasterly direction. Its probable velocity was 4 to 5 miles per day. East of the 73° meridian this current had probably speeded up slightly with an indraft of saltier and warmer water. At about the same meridian the current diverged upon meeting the outflow from the harbor. One branch led to the north of this outflow and further split up into two eddies near Fire Island Inlet and the lower reaches of Long Island. The southerly branch joined the harbor outflow directly and was carried seaward as part of the local current.

The effluent from New York Harbor extended seaward for a distance of 20 to 30 miles and entrained cold, saline water on the north. At the same time, the fresher water was returned towards the coast westerly and southwesterly. The return to the coast of the river effluent was split by two large eddies which straddled the Hudson Gorge giving rise to two distinct longshore currents. The first longshore current more or less hugged the coast and came to an abrupt end just south of Barnegat Inlet. Its minimum speed was from 3 to 4 miles per day, a figure that agrees very well with observed nontidal drifts in that area (Ketchum, Redfield and Ayers, 1951). The offshore current was less distinct with probable velocities from 4 to 5 miles per day. It was probably quite variable, being alternately swelled by longshore influx of saltier water and diminished by loss to seawards of the fresher water.

Further south, off Delaware Bay, rates of travel increased slightly, but these rates were uncertain because of the few local recoveries in the area. Practically all of the bottles, whether released or recovered in this area, drifted for con-The released bottles either were not siderable distance. heard from or stranded near Cape Hatteras. The recoveries were from the offshore New York area and the initial stations near Block Island. In contrast to the New York area, the surface circulation in this vicinity appeared to be relatively simple, although there were few recoveries to support this The longshore current apparently split again just north of Cape May, the seaward portion skirting the comparatively small effluent from Delaware Bay and the landward branch taking an active part in the circulation about the mouth of the bay. The "well-mixed" effluent from Delaware Bay spread in a wide arc whose center was Cape Henlopen and whose radius was limited to 10 to 15 miles. The northern portion of the arc returned part of the effluent in the landward branch of the longshore current. Some of the effluent spread eastward for a short distance and then became merged with a fairly

well-defined longshore current. At Chincoteague Inlet there appeared to be some sort of rotary motion which marked a change in the southerly flowing current, for below the inlet the current became somewhat divergent and ill-defined. This transition also marked an increase in the speed of the current from 4 to 6 miles per day in the Delaware environment to 5 to 7 miles per day.

The surface drifts off Chesapeake Bay were more certain than those of the previous areas because of the higher percentage of recoveries. The minimum rates of travel increased considerably from 8 to as much as 20 miles per day. southerly flowing current was affected by the Chesapeake Bay effluent as far as 40 miles east of Cape Henry where it tended to flow to the west perhaps compensatory to the eastward flowing effluent mixture. This compensatory effect was most pronounced near the mouth of the bay where an anticyclonic eddy apparently was responsible for bottles being carried into the bay itself and for driving some of the fresher water northeast of Cape Charles. South of the 37° parallel the current consisted of effluent water and coastal drift with a speed of 9 to 11 miles per day, the greater figure being more apparent offshore. At 36°40' the current moved shorewards with a consequent speed-up of drift, possibly 12 to 15 miles per day. In an isolated instance, 22 miles per day was recorded. The accelerated drift appeared to be confined by a large cyclonic eddy. It is worth noting that the greatest number of bottles in the survey were collected along the stretch of beach just south of this eddy (36°00' to 36°20').

At Oregon Inlet there was an eddy of cool, saline water which may have funnelled or directed the migration of several bottles into Pamlico Sound similar in action to the eddy further north. The longshore current here comprised residual effluent from Chesapeake Bay combined with coastal drift. The region about Cape Hatteras was very complex with wide ranges of salinity and temperature. No bottles released in this area were recovered in the immediate vicinity. At present, two bottles have been heard from: one, released at a sea buoy just north of Cape Hatteras, drifted to Bermuda in 50 days; the other, released in the Gulf Stream, reached Rhode Island in 72 days. This last bottle suggests a great eddy in which the Gulf Stream is a part, for it was repeated in another instance where a bottle set adrift near Chincoteague Inlet was recovered at Martha's Vineyard 96 days later.

CONCLUSION

To reconstruct the surface coastal circulation in detail from either the surface salinity and temperature data or the drift bottle recoveries alone leaves much to be desired. This is also true, but less so, when the two types of data are combined. In its general aspects the analysis is no doubt convincing, but, as more and more details are deduced the analysis becomes less authentic. In this sense, the pattern of circulation as described here is assumed to be true. There are strong indications that the surface drift was more or less along lines of equal density. However, final estimates and descriptions of the coastal circulation for time of survey must wait for complete examination of the subsurface data.

In spite of the limitations, the surface data were welladapted for describing the surface circulation. The detailed patterns which were developed from the drift bottle recoveries and the salinity-temperature data show that the coastal drift may be made up of several distinct currents or eddies with branches and offshoots merging or breaking away from the general drift. In particular, the influence of each fresh water contributor to the coastal circulation appears to have an appreciable effect upon the current pattern. Ketchum, Redfield, and Ayers (1951) found that off the New York area changing distribution patterns were to be expected when the river flow was small and that a well-defined pattern was developed when the river flow was great. Thus, the assumption of a steady state was ephemeral depending on the conditions. In this respect, the coastal circulation within the 30-fathom curve might be expected to be sensitive to seasonal. and other changes. Consequently, the permanence of the detailed pattern is doubtful and further investigation is needed to determine the basic features of the coastal drift.

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APPENDIX

4

Cart. N Long. W Bottle Sta. Lat. N Long. W - Milles Milles		RECOVERY			REI	RELEASE		MIN	KINIMUM DRIFT	Į	MIN. DRIFT	BTED
74/81 39 31 74 15 4676 1 41 16 71 02 184 5.0 37 230 2/5/51 410 6 71 17 13 0.4 25 11 2/5/51 410 0 71 35 4686 2 41 06 71 17 13 0.4 25 11 1/2/51 41 10 71 35 4690 2 41 06 71 17 13 0.4 25 11 1/2/51 40 08 74 02 4690 2 41 06 71 17 4.0 35 114 1/2/51 40 08 74 06 71 17 13 0.4 25 114 1/2/51 40 08 74 06 71 17 13 0.4 35 114 1/2/51 40 08 74 06 71 17 13 0.4 35 114 1/2/51 40 08 41 06 71 17 14 4.0 35 114 1/2/51 40 0 71 17 <t< th=""><th>4</th><th>٠</th><th></th><th>40</th><th>Sta.</th><th>ند</th><th>=-</th><th>Miles rifte</th><th>elocit mi/day</th><th>Day Adrif</th><th>1es fte</th><th>Vel m/d</th></t<>	4	٠		40	Sta.	ند	=-	Miles rifte	elocit mi/day	Day Adrif	1es fte	Vel m/d
51 40 58 71 35 4666 8 41 06 71 17 53 2.6 19 71 15 53 16 16 11 15 16 11 15 0.6 89 14 10 71 17 13 0.6 89 14 10 71 17 13 0.6 89 14 10 71 17 13 0.6 89 14 10 71 17 13 0.6 89 14 10 71 17 13 0.6 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 4.0 89 14 0.6 71 17 14 9 0.6 18 14 14 14 14	10		4	~	-			184		37	230	6.8
51 41 10 71 33 4693 2 41 06 71 17 13 0.6 25 15 15 16 16 17 17 13 0.6 25 15 16 16 17 17 13 0.6 35 174 4.0 55 17 17 17 17 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 35 174 4.0 36 174 4.0 36 174 4.0 36 174 4.0 36 174 4.0 36 174 4.0 36 174 4.0 37 36 37 36 </td <td>S</td> <td></td> <td>02</td> <td>0</td> <td>02</td> <td></td> <td></td> <td>53</td> <td></td> <td>19</td> <td>77</td> <td>3.7</td>	S		02	0	02			53		19	77	3.7
51 41 10 71 33 4690 2 41 06 71 17 13 0.4 29 14 06 71 17 14 4.0 35 14 4.0 55 17 14 4.0 35 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 14 4.0 35 17 17 17 14 4.0 35 17 18 18 17 18 18 18 18 18 18 18 18 18 18 18 18 18 18 18 18 18 18	S		-	O	02			13		22	15	0.6
51 41 09 71 35 409 71 35 14 35 14 35 14 35 14 35 14 35 14 35 14 35 14 35 177 4.0 35 177 35 177 4.0 35 177 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 177 4.0 35 116 4.0 37 36 177 4.0 36 116 4.0 36 117 4.0 37 36 116 4.0 36 3.0 4.0 6	5		-	a	03			13		62	14	0.5
51 40 08 74 03 4696 8 41 06 71 17 141 4.0 36 177 159 8.0 177 141 4.0 36 177 141 4.0 36 177 177 141 4.0 36 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 177 141 4.0 36 177 178 178 177	S		-	O	2			13		35	14	0.4
51 399 23 74 22 4697 8 41 06 71 17 177 4.9 36 215 51 39 31 74 22 4697 8 41 06 71 17 169 4.6 37 813 51 38 51 74 53 4705 3 41 06 71 17 169 8.6 27 813 51 40 40 55 77 3 23 4705 3 41 06 71 23 96 3.6 27 125 51 40 51 39 19 74 30 4705 3 41 06 71 23 96 3.6 27 125 51 40 51 39 19 74 30 4705 3 41 06 71 23 142 4.3 3.6 22 142 51 39 19 74 30 4705 3 41 06 71 23 142 4.3 3.6 22 142 51 39 49 74 07 400 44 00 44 10 6 71 23 142 4.1 30 440 10 10 10 10 10 10 10 10 10 10 10 10 10	S		4	0	0			141		35	177	2
51 39 31 74 16 4694 8 41 06 71 17 169 4.6 37 815 846 84	1		. 4	a	0					36	918	
51 36 56 74 53 4691 8 41 66 71 17 8.9 75 84 66 71 8.9 75 84 66 71 8.9 75 84 66 71 8.9 75 84 66 71 8.9 75 84 86 76 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 86 87 87 87 87 87 87 87 87 87 87 87 87 87 87 87 87 87 87 87 88 87 87 88 87 87 88 87 87 88 87 87 88 87 87 88 87 87 88 87 87 <	1		. 4	0	3 0			160		3.6	210	
40 40<	2 (. 4	4691	3 0			210		2 6	040	
40 35 73 30 4700 3 41 06 71 23 97 3.5 89 126 87 126 89 126 87 <t< td=""><td>13/02/</td><td></td><td></td><td>4705</td><td>1 16</td><td></td><td></td><td>- d</td><td></td><td>200</td><td>98.</td><td></td></t<>	13/02/			4705	1 16			- d		200	98.	
51 40 77 25 4705 3 41 06 71 25 148 4.3 159	1 4/51) NC	4700) (4)			26		2 6	100	. 4
51 39 56 74 04 4702 3 41 06 71 23 142 4.3 35 169 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 214 5.0 36 37 40 188 214 37 40 188 214 36 37 40 188 214 40 118 214 40 118 214 40 118 214 40 118 214 80 118 214 218 214 218 <td>19/9/</td> <td></td> <td></td> <td>4703</td> <td>60</td> <td></td> <td></td> <td>9</td> <td></td> <td>2 %</td> <td>184</td> <td>4.3</td>	19/9/			4703	60			9		2 %	184	4.3
51 39 19 74 30 4706 3 41 06 71 23 179 5.0 36 214 51 40 04 74 02 4706 3 41 06 71 83 151 4.1 37 189 51 40 04 74 08 41 06 71 83 148 1.0 188 189	19/01/8		4	4708				149		100	160	2
51 39 42 74 07 4698 3 41 06 71 23 151 4.1 57 189 51 40 04 74 02 4708 3 41 06 71 23 148 3.6 38 165 51 40 04 72 55 4708 3 41 06 71 23 148 3.7 40 188 51 40 24 72 55 4709 3 41 06 71 23 148 3.7 40 188 51 39 30 74 45 4712 4 059 71 48 811 4.2 40 188 51 39 01 74 45 4727 5 40 39 71 48 811 4.2 5 18 884 51 39 02 74 45 40 59 71 56 845 5.0 41 884 88 <td>713/21</td> <td></td> <td>4</td> <td>4706</td> <td>67</td> <td></td> <td></td> <td>179</td> <td></td> <td>36</td> <td>214</td> <td>2</td>	713/21		4	4706	67			179		36	214	2
51 40 04 74 02 4708 3 41 06 71 23 138 3.6 38 165 51 40 42 72 55 4699 3 41 06 71 23 148 3.7 40 138 51 39 49 74 05 4701 3 41 06 71 23 148 1.8 4.7 45 188 155 3.7 40 138 158 165 3.7 40 138 165 3.7 40 138 165 3.7 40 138 165 3.7 40 138 165 3.7 40 138 165 3.7 40 138 166 4.7 45 188 188 168 188 168 18 </td <td>/14/51</td> <td></td> <td>4</td> <td>4698</td> <td>10</td> <td></td> <td></td> <td>151</td> <td></td> <td>37</td> <td>189</td> <td>5.1</td>	/14/51		4	4698	10			151		37	189	5.1
51 39 49 74 05 4701 3 41 06 71 83 148 5.7 40 158 51 40 42 72 55 4699 3 41 06 71 83 74 1.8 40 158 51 38 35 75 03 4712 4 40 59 71 48 811 4.7 45 827 40 158 71 48 821 4.7 40 158 71 48 11.8 40 158 71 48 11.8 40 158 71 48 183 2.6 51 828 71 40 183 71 60 188 71 80 188 71 80 188 71 80 188 71 80 188 71 80 188 71 80 188 71 80	/15/51		-	4708	10			138		38	165	4.3
51 40 42 72 55 4699 3 41 06 71 83 74 1.8 40 138 74 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 45 827 820 827 827 820 827 827 820 827 827 820 827 827 827 827 827 827 827 827 827 827 827 827 827 828	/11/51		4	4701	10			148		40	182	4.5
51 36 35 75 03 4712 4 40 59 71 48 211 4.7 45 224 51 39 03 71 46 4712 4 40 59 71 46 183 3.6 51 226 51 236 71 44 37 226 51 37 47 47 47 47 47 47 47 47 47 47 47 226 51 37 47 47 226 51 37 47 47 226 47 47 226 50 47 47 226 50 47 226 50 47 226 50 47 226 50 50 47 226 50 50 47 226 50 50 47 50 50 47 50 50 50 47 50 50 50 50 50 50 </td <td>/11/51</td> <td></td> <td>a</td> <td>4699</td> <td>10</td> <td></td> <td></td> <td>74</td> <td></td> <td>40</td> <td>138</td> <td>3.4</td>	/11/51		a	4699	10			74		40	138	3.4
51 39 01 74 46 4712 4 0 59 71 48 185 3.6 51 824 51 39 03 74 45 4723 5 40 39 71 56 164 4.4 37 801 51 37 48 75 20 4723 5 40 39 71 56 223 5.0 47 80 51 37 48 75 05 4744 6 40 11 72 09 180 4.6 39 826 51 37 54 75 03 4742 6 40 11 72 09 180 4.6 39 826 51 37 54 77 0 6 40 11 72 09 180 4.6 39 826 51 37 54 77 0 6 40 11 72 09 180 4.6 4.6 4.0 172 0 4.6 4.6 172 0 8.6	/28/51		10	4713	4			211		45	287	5.0
51 39 03 74 45 4727 5 40 39 71 56 164 4.4 37 201 51 37 52 47 5 40 39 71 56 164 4.4 37 201 51 37 46 47 40 39 71 56 247 39 2.7 89 280 51 36 37 47 40 11 72 09 170 4.2 39 280 51 37 54 47 6 40 11 72 09 170 4.2 39 280 51 37 54 47 6 40 11 72 09 170 4.2 41 20 51 36 27 40 28 72 39 186 5.2 36 215 215 216 30 30 30	/88/51		-	4712	4			183		51	884	4.4
51 37 52 75 20 4723 5 40 39 71 56 235 5.0 47 252 51 37 48 75 30 4731 5 40 39 71 56 243 5.0 47 252 51 38 27 75 05 4744 6 40 11 72 09 180 4.6 39 220 51 38 27 75 03 4742 6 40 11 72 09 170 4.6 39 220 51 37 54 75 03 4179 7 40 22 72 39 186 5.2 36 215 51 38 02 75 03 4176 7 40 22 72 39 186 5.2 36 215 51 30 20 4174 7 40 22 72 39 186 5.2 36 172 266 51 40 40 73 01 4187 8 40 34 73 12 12 4.0 3 12	/14/51		-	4727	10			164		37	201	5.4
51 37 48 75 30 4731 5 40 39 71 56 243 2.7 89 256 51 36 19 75 05 4744 6 40 11 72 09 180 4.6 39 220 51 36 27 75 03 4742 6 40 11 72 09 170 4.2 41 200 51 37 54 75 03 4179 7 40 22 72 39 186 5.2 36 215 51 36 31 75 03 4179 7 40 22 72 39 186 5.2 36 215 51 36 31 75 03 4174 7 40 22 72 39 158 3.6 44 172 51 40 40 75 01 4185 8 40 34 73 12 12 4.0 3 12 51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12	/84/51		10	4723	ß			833		47	252	5.4
(17/51 36 19 75 05 4744 6 40 11 72 09 180 4.6 39 220 (19/51 36 27 40 11 72 09 170 4.8 41 200 (20/51 37 54 75 03 4179 7 40 22 72 39 220 22 72 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 172 245 245 172 245 172 245 172 245 172 245 172 245 245 172 245 172 245 172 245 244 172 245 245 245 245 245 245 245 245 245 245 245	/ 5/51			4731	2			243		89	856	8.3
19/51 36 87 75 03 4742 6 40 11 72 09 170 4.8 41 200 20/51 37 54 75 19 4740 6 40 11 72 09 207 2.9 72 245 14/51 36 02 75 03 4179 7 40 22 72 39 186 5.2 36 215 16/51 36 31 75 03 4174 7 40 22 72 39 158 3.6 44 172 10/51 37 25 4174 7 40 22 72 39 225 25 36 215 12/51 40 40 73 01 4185 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 3 12 12/51	11			4744	9			180		39	220	5.6
20/51 37 54 75 19 4740 6 40 11 72 09 207 2.9 72 245 14/51 36 02 75 03 4179 7 40 22 72 39 186 5.2 36 215 16/51 37 25 75 03 4178 7 40 22 72 39 158 3.6 44 172 10/51 37 25 75 41 4175 7 40 22 72 39 236 215 44 172 10/51 37 25 75 41 4174 7 40 22 72 39 238 256 44 172 12/51 40 40 73 01 4185 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 3 12	119			4748	9			170		41	800	4.9
14/51 36 02 75 03 4179 7 40 22 72 39 186 5.2 36 215 22/51 36 31 75 03 4178 7 40 22 72 39 158 3.6 44 172 10/51 37 25 75 41 4175 7 40 22 72 39 232 256 36 44 172 10/51 37 25 4174 7 40 22 72 39 232 256 44 172 12/51 40 40 73 01 4185 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4188 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 3 12	63		10	4740	9			202		72	245	3.4
22/51 36 31 75 03 4176 7 40 22 72 39 158 3.6 44 172 10/51 37 25 75 41 4175 7 40 22 72 39 252 252 253 268 10/51 37 25 75 09 4174 7 40 22 72 39 179 1.6 110 206 12/51 40 40 73 01 4185 8 40 34 73 12 12 12 12 12/51 40 40 73 01 4186 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4186 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12	7			4179	7			186		36	215	6.0
10/51 37 25 75 41 4175 7 40 22 72 39 252 2.5 93 268 27/51 36 11 75 09 4174 7 40 22 72 39 179 1.6 110 206 12/51 40 40 73 01 4185 8 40 34 73 12 12 12 12 12/51 40 40 73 01 4186 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4188 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 5 12	03		10	4178	7			158		44	172	3.9
/27/51 38 11 75 09 4174 7 40 22 72 39 179 1.6 110 206 /12/51 40 40 73 01 4185 8 40 34 73 12 12 4.0 3 12 /12/51 40 40 73 01 4186 8 40 34 73 12 12 4.0 3 12 /12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 /12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12				4175	2			232		93	898	8.8
12/51 40 40 73 01 4185 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4187 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12				17	2			179		110	506	1.9
12/51 40 40 73 01 4187 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4188 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12 12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12			-	18	80			18		100	30	4.0
/12/51 40 40 73 01 4188 8 40 34 73 12 12 4.0 3 12 /12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12			-	18	00			18		, FO	200	4.0
/12/51 40 40 73 01 4189 8 40 34 73 12 12 4.0 3 12			-	18	00			3		10	100	4
	/18/			18	0 00			2 0) M	20	4
				2	,			1		,	:	:
											¥	

	RECOVERY			REI	RELEASE		KINIKOK	NUM DRIFT		MIN. DRIFT	RIFT
Date	Let. N	Long. W	Bottle	Sta.	Lat. N	Tong. W	Miles drifted	Velocity mi/day	Days	Wiles Drifted	Vel.
18/	400	10	4190	80		10	18		ю	18	4.0
18/		2	4191	00		10	10		ဗ	đ	3.5
18		10	4192	æ		10	10		ю	0	3.5
12/		10	4193	00		10	10		80	0	3.5
12/		10	4195	00		60	10		10	O	3.5
12/		10	4196	00		10	10			10.5	3.5
20/		4	4206	o		10	44	•	11	10	4.8
21/		4	4203	0		10	45	•	18	59	4
21/18		4	4207	. 0		10	42	•	18	61	2
21/2		4	4208	0		10	48	•	18	89	2.5
28		4	4204	6		10	44		13	55	4
24/		4	4197	0		10	41	•	15	12	4.7
6		10	4200	6		10	18	•	31	14	4.0
6/21/51	38 59	74 48	4808	6	40 87	73 13	116	8.5	43	138	3.1
23/		4	4198	6		2	109		45	131	6.3
/13		4	4809	10		10	31		18	3	3.8
12		4	4211	10		10	38		18	43	3.6
/12/		4	4213	10		20	68		18	36	3.0
12		4	4214	10		10	35		18	49	4.1
12		4	4219	10		10	35		12	49	4.1
/33		4	4217	10		10	31		13	41	3.8
122		4	4218	10		10	41		13	57	4.4
24		4	4220	10		10	32		15	48	3.8
6		4	4210	10		10	34		61	55	6.0
19		S	4221	11		2	02		10	12	2.1
19		4	4222	11		2	80		10	ai	8.8
19		4	4225	11		2	80		10	22.5	8
19/		4	4227	11		2	88		10	-	4.1
18/		4	4229	11		2	08		10	21	2.1
761		4	4230	11		63	33		10	47	4.7
19/		4	4232	11		2	38		10	48	4.8
108		4	4884	11		10	22		11	45	4.1
20/2		4	4228	11		10	23		11	48	4.3
18/2		4	4239	18		73 54	83		6	43	4.8

	RECOVERY				RELEASE		MINI	MINIMUM DRIFT		MIN.	STED
Date	Lat. N	Long. W	Bottle	Sta.	Lat. N	Long. W	Miles drifted	Velocity mi/day	Days	Wiles Drifted	Vel. m/d
5/18/51		4	4238	12		10	86		6	47	5.2
5/18/51		4	4243	12		10	88		6	42	4.7
5/19/51		4	4237	12		19	16		10	16.5	1.6
5/19/51		4	4841	18		10	231		10		5.3
5/27/51		4	4235	12		10	35		18	71	3.9
5/82/51		4	4242	12		2	21		13	47	3.6
5/18/51		4	5414	13		10	87		6	27	3.0
5/18/51	39 55	74 04	5415	13	40 80	73 52	22		6	88	3.1
5/18/51		4	5418	13		10	22		o	88	3.1
5/18/51		4	5419	13		10	23		6	27	3.0
5/18/51		4	5422	13		10	23		6	27	3.0
5/80/51		4	5420	13		10	35		11	43	3.9
5/24/51		4	5484	13		2	27		15	58	3.9
5/30/51		4	5421	13		10	88		12	67	3.8
6/ 3/51		4	5416	13		m	23		25	48	1.9
5/20/51		4	5401	14		10	33		=	42	3.8
5/20/51		4	5406	14		10	48		11	09	5.4
5/22/51		4	5411	14		10	67		13	84	6.4
5/30/51		4	5409	14		10	53		13	87	4.1
6/ 9/51		4	5396	15		10	83		31	108	3.5
6/ 9/51		4 .	5391	15		10	93		31	115	3.7
11/21		4	5393	15		2	96		83	121	3.6
6/12/51		2	5392	15		2	150		34	190	5.6
16/21/9		4	5400	15		2	88		34	117	3.4
16/81/9		2	5395	15		10	143		40	187	4.7
6/22/51		2	5398	15		2	160		44	176	4.0
16/12/9		2	5399	15		2	149		49	165	3.4
6/30/51		2	5431	16		10	129		52	800	3.8
6/26/51		2	5430	16		2	196		48	246	5.1
6/20/51		2	5446	17		2	271		48	342	8.1
6/20/51		2	5448	17		2	267		48	356	8.5
6/24/51		0	5441	17		2	818		46	302	9.9
7/82/51		2	4	17		6	859		74	300	4.1
5/18/51		4	5453	18		73 39	17	1.9	6	38	4.8

Date	-	RECOVERY			RELEASE		MIN	MINIMUM DRIFT	1	MIN. DRIFT	DRIFT
	Lat. N	Long. W	Bottle	Sta.	Lat. N	Long. W	Miles drifted	Velocity mi/day	Days	Miles Drifted	Vel m/đ
16/61/0	100	7.4	5449	18	0	10	18		10	41	
19/61/		74	5450	18	0	8	17		10	40	
19/61/9		7.4	5451	18	0	3	18		10	45	
19/61/		74	5454	18	0	50	19		10	45	
19/61/9		7.4	5455	18	0	50	18		101	41	
/19/51		74	5456	18	0	50	08		10	46	4.6
19/61/9		7.4	5458	18	0	50	18		10	45	
19/61/9		74	5459	18	0	50	17		10	48	•
3/19/51		-	5460	18	0	50	19	•	101	45	
15/02/9		44	5452	18	0	8	2		ä	47	
5/20/51		74	4607	19	0	3 4	15		2	48	
1/80/21		74	4613	19	0	3 4	15		10	48	
5/26/51		74	4608	19	0	3 4	19		16	09	
5/26/51		74	4605	19	0	3 4	16		16	69	
1/56/51		74	4606	19	0	3 4	18		16	22	
1/56/51		74	4609	19	0	3.4	16		16	69	
19/92/9		7	4610	19	0	3 4	18		91 .	78	
1/86/51		74	4612	19	0	3 4	18		16	7.8	
19/98/9		74	4612	19	0	3 4	18		16	7.8	
/81/21		74	4611	19	0	3 4	17		17	78	
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12/02/9		74	4603	19	0	3 4	17		02	22	
14/51		75	4617	08	•	3 4	148		35	160	
/23/51		75	4618	08	0	3 4	202		44	247	
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1/4/21		75	4614	02	•	3 4	184		98	214	
14/51		75	4639	88	•	8	141		35	157	
19/11/9		75	64	88	0	3	139		38	150	
/88/51		75	4641	88	•	3	156		73	170	
2		75	4	88	0	3	138		87	143	
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	Bottle	0085	5810	5811	5812	5813	5814	5815	5816	4426	4428	4435	4429	4430	4	4433	4	4436	4432			4		4416			4488	4480	4421			4	4439	4440	4
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RECOVERY	Lat. N				36 48			200																											
	Date	1/2	5/14/51	10	5/14/51	10	10	D	IO	O	10	0	0	5/19/51	10	19/5	/19/	5/19/51	5/20/51	5/21/51	5/18/51	5/18/51	5/19/51	5/19/51	5/19/51	5/19/51	5/20/51	5/87/51	6/14/51	17/5	18/5	18/5	-	9/6	/19/2

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	RECOVERY				RELEASE		MIN	MINIMUM DRIFT	£	ADJUSTED MIN. DRIFT	RIFT
Date	Lat. N	Long. W	Bottle	Sta.	Lat. N	Long. W	Wiles drifted	Velocity mi/day	Days Adrift	Miles drifted	Vel. m/d
9	100	2	41	102		S	88		3	30	10.0
6		2	41	108		2	88		ю	30	10.0
6		2	4389	103		2	38		60	37	Q
5/16/51	36 13	75 46	4390	103	36 40	75 51	88	9.3	60	68	9.7
6		0	39	103		2	227		10	88	9.1
6		2	4398	103		2	83	•	เก	28.5	9.5
6		2	4393	103		2	38		ю	37	12.3
9		2	4394	103		2	98		ю	86.5	8.8
9		2	4395	103		2	98		ю	86.5	8.8
6		2	4397	103		2	98		ຄ	86.5	8.8
6		2	4398	103		2	98		60	26.5	8.8
9		9	4399	103		2	88			28.5	9.6
7		2	6058	105		2	34		18	40	8.8
2		2	6057	105		2	58		32	65	0.3
3		2	6067	105		2	4		9	45	9.0
2		2	9909	105		2	37		9	40	7.0
6		2	6099	105		2	39		92	4	9.0
8		2	9809	107		2	48		14	138	6.6
2		2	6091	107		2	67		7.8	103	-
2		2	5036	108		2	17		1	17	-
2		2	5037	108		0	17		1	16	16.0
2		2	5038	108		2	17		1	16	9
2		2	5040	108		2	17	•	1	16	9
2		2	5044	108		2	18		1	18.5	8
2		2	5045	108			18		٦	18.5	8
3		2	5035	108			18		03	18	0.6
2		2	5039	108			17		02	16,5	8.8
3		ú	5041	108			17		03	16.5	8.8
6		2	5042	108		5 4	15		03	16	8.0
6		2	5043	108		2	18		03	18	0.6
3		0	5034	108		5 4	17		6	17	1.9
6		2	5046	109		5 4	7		02	7.5	3.7
6		2	5047			0	7		02	7.5	3.7
6		2	5048	. 109		4	80		03	o	4.5

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		- 900	Bottle	Sta.	Lat. N	rong.	Wiles drifted	welcoldy m1/day	Days	Wiles	Vel m/d
		2	5049	109	9	S	∞		Q	6	4
		2	5050	109	9	2			03		60
		2	5051	109	9	2	7		03		3
		2	5052	109	9	S	7		Q	7.5	10
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		0	9606	211	0	0	27	•		27	0
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		2	4593	147	6	10	808		32	309	6
		2	4596	147	6	10	202		33	305	0
		2	4145	149	0	10	126		68	146	5
		2	4141	149	6	10	130		68	146	2
		2	4148	149	6	10	189		47	247	2
_		0	4144	149	6	10	123		64	150	2
		2	4147	149	6	10	138		87	148	-
		2	4148	149	6	2	132		86	148	
		4	0	150	6	2	54		88	80	
		2	4154	150	6	10	111		40	120	6
		2	3	150	6	2	145		89		
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			41 67	151	40 00	72 46	151	4.9	3	195	9

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	RECOVERY			R	RELEASE		MINI	MINIMUM DRIFT	ę,	ADJUSTED MIN. DRIF	STED
Date	Lat. N	Long. W	Bottle	Sta.	Lat. N	Long. W	Wiles	Velocity mi/day	Days	Miles	Wel.
6/86/51	1	1000	4161	151			137		37	195	
6/24/51			5848	152			195	5.6	35	240	
6/22/51	38 58	74 49	5834	153	40 36	78 07	162	4,9	33	190	5.8
6/21/51			4128	154			156	4.9	82	192	•
8/26/51			5397	15			161	109	1.5		
8/89/51	35 35	75 27	6609	112	35 47	75 29	12	107	0.1	13	0.1
9/ 3/21			4643	222			613	077	7.		•

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